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CNAS L0699



TEST REPORT

CEPRI-EETC08-2022-0480 (E)

Client: ZGHD ELECTRIC CO.,LTD.

Object: 12/20(24)kV screened separable connector

Type: GHD-20/630A 3×185

Test Category: Type Tests



POWER INDUSTRY QUALITY INSPECTION AND TEST
CENTER FOR ELECTRIC EQUIPMENT



Catalogue

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电力工业
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Test Report	Power Industry Quality Inspection and Test Center for Electric Equipment		CEPRI-EETC08-2022-0480(E) Total 20 Page 2
Client	ZGHD ELECTRIC CO.,LTD.	Manufacturer	ZGHD ELECTRIC CO.,LTD.
Object	12/20(24)kV screened separable connector	Type	GHD-20/630A 3×185
Sampling procedure	by the Client	Serial No.	EETC08-22/07/27-001
Test Category	Type Tests	Date	2022.10.08~2023.02.22
Requirements	<p>1. GB/T 12706.4—2020 Power cables with extruded insulation and their accessories for rated voltages from 1 kV ($U_m=1.2$ kV) up to 35 kV ($U_m=40.5$ kV) — Part 4: Test requirements on accessories for cables with rated voltages from 6 kV ($U_m=7.2$ kV) up to 35 kV ($U_m=40.5$ kV)</p> <p>2. IEC 60502-4:2010 Power cables with extruded insulation and their accessories for rated voltages from 1 kV ($U_m=1.2$ kV) up to 30 kV ($U_m=36$ kV) - Part 4: Test requirements on accessories for cables with rated voltages from 6 kV ($U_m=7.2$ kV) up to 30 kV ($U_m=36$ kV)</p>		
Conclusion	<p>According to GB/T 12706.4—2020 and IEC 60502-4:2010, type tests were performed on 12/20(24)kV screened separable connectors which were provided by ZGHD ELECTRIC CO.,LTD. All the results were in accordance with the requirements.</p>		
Note	<p>In the event of any difference in meanings, the Chinese report shall take priority over the English version.</p>		
Tested by: 韩卫京	韩卫京	赫留洋	赫留洋
Checked by: 张伟	张伟	Verified by: 彭超	彭超
Approved by: 阎孟昆	阎孟昆	Date of issue: 2023-03-07	



Test Results

No.	Item	Requirements	Results	Evaluation
1	Sequence 4.1	/	/	/
1.1	AC voltage test	No breakdown shall occur at 54kV for 5 min	No breakdown occurred on the combination samples at 54kV for 5 min	passed
1.2	DC voltage test	No breakdown shall occur at 48kV for 15 min	No breakdown occurred on the combination samples at 48kV for 15 min	passed
1.3	Partial discharge test at ambient temperature	The magnitude of the discharge at 20kV shall not exceed 10pC	No detectable discharge exceeding the sensitivity (3.8pC) at 20kV	passed
1.4	Impulse voltage test at 95 °C ~ 100 °C	No breakdown shall occur at 10 positive and 10 negative impulses of 125kV	No breakdown occurred on the combination samples at 10 positive and 10 negative impulses of 125kV (See Appendix C.1)	passed
1.5	Heating cycle voltage test	No breakdown shall occur during 30 cycles in air and 30 cycles under water at the conductor temperature of 95°C to 100°C and 30kV	No breakdown occurred on the combination samples during 30 cycles in air and 30 cycles under water at the conductor temperature of 95°C to 100°C and 30kV	passed
1.6	Partial discharge test at 95°C ~ 100°C	The magnitude of the discharge at 20kV shall not exceed 10pC	No detectable discharge exceeding the sensitivity (4.0pC) at 20kV	passed
1.7	Partial discharge test at ambient temperature	The magnitude of the discharge at 20kV shall not exceed 10pC	No detectable discharge exceeding the sensitivity (4.4pC) at 20kV	passed
1.8	Impulse voltage test	No breakdown shall occur at 10 positive and 10 negative impulses of 125kV	No breakdown occurred on the combination samples at 10 positive and 10 negative impulses of 125kV (See Appendix C.2)	passed
1.9	AC voltage test	No breakdown shall occur at 30kV for 15min	No breakdown occurred on the combination samples at 30kV for 15min	passed



No.	Item	Requirements	Results	Evaluation
1.10	Examination	It is advised that the accessory is examined for signs of any of the following: (i) cracking in the filling media and/or tape or tube components; (ii) a moisture path across a primary seal; (iii) corrosion and/or tracking and/or erosion; (iv) leakage of an insulating material.	(i) No cracking in the filling media and tape or tube components; (ii) No moisture path across a primary seal; (iii) No evident corrosion, tracking and erosion; (iv) No leakage of an insulating material.	passed
2	Sequence 4.2 and 4.3	/	/	/
2.1	AC voltage test	No breakdown shall occur at 54kV for 5min	No breakdown occurred on the combination samples at 54kV for 5min	passed
2.2	DC voltage test	No breakdown shall occur at 48kV for 15min	No breakdown occurred on the combination samples at 48kV for 15min	passed
2.3	Thermal short-circuit test (screen)	No visible deterioration at 3.5kA, 1 s, twice	No visible deterioration at 3.54kA, 1.0400s and 3.55kA, 1.0385s(See Appendix C.4)	passed
2.4	Thermal short-circuit test (conductor)	No visible deterioration at 24.1kA, 2s, twice	No visible deterioration at 24.89kA, 2.0327s and 24.93kA, 2.0314s(See Appendix C.5)	passed
2.5	Dynamic short-circuit test	No visible deterioration at 85.2kA, not less than 10ms	No visible deterioration at 85.90kA, 78.5ms (See Appendix C.6)	passed
2.6	Impulse voltage test	No breakdown shall occur at 10 positive and 10 negative impulses of 125kV	No breakdown occurred on the combination samples at 10 positive and 10 negative impulses of 125kV (See Appendix C.3)	passed
2.7	AC voltage test	No breakdown shall occur at 30kV for 15min	No breakdown occurred on the combination samples at 30kV for 15min	passed



No.	Item	Requirements	Results	Evaluation				
2.8	Examination	It is advised that the accessory is examined for signs of any of the following: (i) cracking in the filling media and/or tape or tube components; (ii) a moisture path across a primary seal; (iii) corrosion and/or tracking and/or erosion; (iv) leakage of an insulating material.	(i) No cracking in the filling media and tape or tube components; (ii) No moisture path across a primary seal; (iii) No evident corrosion, tracking and erosion; (iv) No leakage of an insulating material.	passed				
3	Other items	/	/	/				
3.1	Screen resistance tests	Screen resistance before and after the heating period shall not exceed 5000Ω	<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:30%;">before ageing</td> <td style="width:70%;">150.3Ω</td> </tr> <tr> <td>after ageing</td> <td>44.8Ω</td> </tr> </table>	before ageing	150.3Ω	after ageing	44.8Ω	passed
before ageing	150.3Ω							
after ageing	44.8Ω							
3.2	Screen leakage current	Screen leakage current shall not exceed 0.5mA at 24kV	Screen leakage current didn't exceed 0.5mA at 24kV	passed				

Content

1. Sequence 4.1 in Table 5 of GB/T 12706.4—2020

1.1 AC voltage test

No breakdown occur at 54kV for 5min.

Result: Passed.

1.2 DC voltage test

No breakdown occurred at 48kV for 15min.

Result: Passed.

1.3 Partial discharge test at ambient temperature

The test voltage was raised gradually to and held at 24kV for 10s and then slowly reduced to 20kV.

Requirements	Result			
	Phase	Noise background (pC)	Sensitivity (pC)	Discharge (pC)
20kV, the magnitude of the discharge shall not exceed 10pC	Y	1.9	3.8	1.9
	G	1.9	3.8	1.9
	R	1.9	3.8	1.9

Result: Passed.



1.4 Impulse voltage test at 95°C~100 °C

The conductor of the cable was heated and stabilized for at least 2h at a temperature of 95 °C ~ 100 °C. No breakdown occurred at 10 positive and 10 negative impulses of 125kV(See Appendix C.1).

Result: Passed.

1.5 Heating cycle voltage test

Each heating cycle in air was at least 8h duration with at least 2h at a steady temperature of 5°C to 10°C above the maximum cable conductor temperature in normal operation, followed by at least 3h of natural cooling to within 10 °C of ambient temperature. No breakdown occurred during 30 cycles in air and 30 cycles under water at the conductor temperature of 95°C to 100°C and 30kV.

Result: Passed.

1.6 Partial discharge test at 95 °C~100 °C

The test voltage was raised gradually to and held at 24kV for 10s and then slowly reduced to 20kV. The conductor temperature was 95°C to 100°C during the test.

Requirements	Result			
	Phase	Noise background (pC)	Sensitivity (pC)	Discharge (pC)
20kV, the magnitude of the discharge shall not exceed 10pC	Y	2.0	4.0	2.0
	G	2.0	4.0	2.0
	R	2.0	4.0	2.0

Result: Passed.

1.7 Partial discharge test at ambient temperature

The test voltage was raised gradually to and held at 24kV for 10s and then slowly reduced to 20kV.

Requirements	Result			
	Phase	Noise background (pC)	Sensitivity (pC)	Discharge (pC)
20kV, the magnitude of the discharge shall not exceed 10pC	Y	2.2	4.4	2.2
	G	2.2	4.4	2.2
	R	2.2	4.4	2.2

Result: Passed.

1.8 Impulse voltage test

No breakdown occurred at 10 positive and 10 negative impulses of 125kV(See Appendix C.2).

Result: Passed.

1.9 AC voltage test

No breakdown occurred at 30kV for 15 min.

Result: Passed.

1.10 Examination

Check the samples with eyes:(i) no cracking in the filling media and tape or tube components;(ii) no moisture path across a primary seal;(iii) no evident corrosion and tracking and erosion;(iv) no leakage of



an insulating material.

Result: Passed.

2. Sequence 4.2 and 4.3 in Table 5 of GB/T 12706.4—2020

2.1 AC voltage test

No breakdown occurred at 54kV for 5min.

Result: Passed.

2.2 DC voltage test

No breakdown occurred at 48kV for 15min.

Result: Passed.

2.3 Thermal short-circuit test (screen)

At the beginning of the test, the cable conductor was heated to reach a steady temperature of 5 °C to 10 °C above the maximum cable conductor temperature in normal operation and shall last for at least 2 h. Then two short-circuits were applied to the screen. The short-circuit current and duration time was specified as the agreement between manufacturer and user according to the actual short-circuit condition of the power grid. Between the two short-circuits, the test loop was allowed to cool to a temperature less than 10 °C above its temperature prior to the first short-circuit. There was no visible deterioration on the samples.

Ambient temperature: 12.0 °C

Requirements	Result
No visible deterioration at 3.5kA, 1s, twice	No visible deterioration at 3.54kA, 1.0400s and 3.55kA, 1.0385s (See Appendix C.4)

Result: Passed.

2.4 Thermal short-circuit test (conductor)

Two short-circuits were applied using AC to raise the conductor temperature to the maximum permissible short-circuit temperature(250 °C) of the cable within 5 s. Between the two short-circuits, the test loop was allowed to cool to a temperature less than 10 °C above its temperature prior to the first short-circuit. There was no visible deterioration on the samples.

Ambient temperature: 12.0 °C

Requirements	Result
No visible deterioration at 24.1kA, 2s, twice	No visible deterioration at 24.89kA, 2.0327s and 24.93kA, 2.0314s(See Appendix C.5)

Result: Passed.

2.5 Dynamic short-circuit test

The dynamic short-circuit current value was 2.5 times of the thermal short-circuit value when the thermal short-circuit time equals 1s. There was no visible deterioration on the samples after the short-circuit lasts for at least 10ms.

Ambient temperature: 12.0 °C



Requirements	Result
No visible deterioration at 85.2kA, not less than 10ms	No visible deterioration at 85.90kA, 78.5ms (See Appendix C.6)

Result: Passed.

2.6 Impulse voltage test

No breakdown occurred at 10 positive and 10 negative impulses of 125kV(See Appendix C.3).

Result: Passed.

2.7 AC voltage test

No breakdown occurred at 30kV for 15min.

Result: Passed.

2.8 Examination

Check the samples with eyes:(i) no cracking in the filling media and tape or tube components;(ii) no moisture path across a primary seal;(iii) no evident corrosion and tracking and erosion;(iv) no leakage of an insulating material.

Result: Passed.

3. Other items in Table 5 of GB/T 12706.4—2020

3.1 Screen resistance test

Screen resistance before and after the heating period shall be measured at ambient temperature. According to clause 8.1 in GB/T 2951.2, the sample shall be placed in the air oven at the temperature of $(120 \pm 2)^\circ\text{C}$ for 168h during the heating period.

Requirements	Result	
	before ageing	after ageing
Screen resistance before and after the heating period shall not exceed 5000 Ω	150.3 Ω	44.8 Ω

Result:passed.

3.2 Screen leakage current

A metal foil of 25 cm² (namely 5cm×5cm) shall be fixed to the outer shield of the separable connector as far as possible from the ground point (There shall be no air gap between the metal foil and the outer shield). The metal foil shall be grounded through a resistance of 2000 Ω , and an AC voltage of 24kV shall be applied between the cable conductor of the combination samples and the ground to measure the leakage current. The magnitude of screen leakage current wasn't exceed 0.5mA.

Result:passed.

Appendix A Object Parameters

A.1 Sample information

The sample was received by Power Cable Station on 27/07/2022. The sample was in good condition.The sample is designed with stress cone structure and the raw liquid material is EPDM. The material of connector is T2 copper. The cable conductor is compacted with the connector by confining pressure.



A.2 The number and installation of samples

According to GB/T 12706.4—2020, It was required that two sets of samples to be tested were installed by the manufacturer on two length of cables forming combination samples on which the type tests sequence 4.1, 4.2, 4.3 and additional testing items were carried out. The cable used in the combination samples was a XLPE insulated three-core cable for rated voltage 12/20kV, a cross-section of 185sq.mm. The length of the cable in the combination sample was greater than 5m between terminations and the samples. Other type tests listed in table 5 were carried out on other samples.

A.3 Photograph of samples



A.4 Photograph of dissected samples



检验合格



Appendix B The Main Test Devices

No.	Name/ Type/ Specification	Serial No.	Measurement Range	Uncertainty / Accuracy class / Maximum Permissible Error	Calibration Institute	Valid Date
1	YD(W)-JZ-30/150 AC/DC Test Device	EETC08-0069	(0~150)kV	Grade 3	National high voltage measurement station	2023.06.27
2	CQSB(J)-120/60 60kV Power frequency test device	EETC08-0054	(0~60)kV	Class 3	National high voltage measurement station	2023.06.27
3	JFD-2H PD measurement system	EETC08-0013	(0.5~1000) pC	Class 10	National high voltage measurement station	2023.05.09
4	FY I 900/600 Weakly damped capacitive voltage divider	EETC08-0019	(0~900) kV	Class 3	National high voltage measurement station	2024.06.15
5	H-DJF-2 Data collected system	EETC05-2055	(0~100) kA	Class 0.5	National high voltage measurement station	2024.05.23
6	LCC-V Heating cycle monitoring system	EETC08-0043	(0~3000) A	Class 0.5	National high voltage measurement station	2023.03.30
7	TP700 Multichannel data recorder	EETC08-0153	(0~200)°C	±2°C	Vkan Certification & Testing Co., Ltd. Measuring Center	2023.11.30

Appendix C Waveforms

C.1 The values and waveforms of impulse voltage on the combination samples before heating cycles voltage test

C.1.1 The values of impulse voltage test

Ambient temperature: 9.0°C

Relative humidity: 47%

Atmosphere: 0.1030MPa

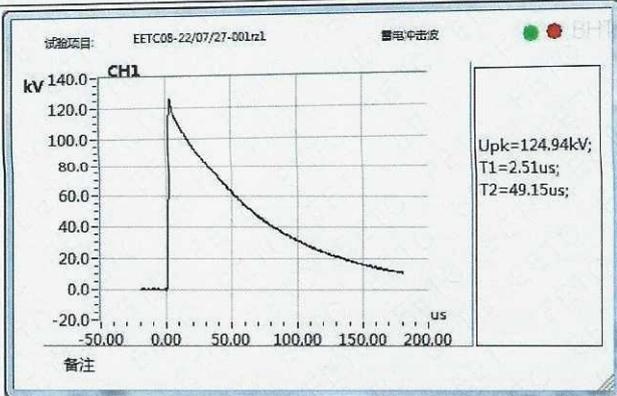
Positive polarity (kV)	124.9	127.5	127.7	127.0	126.1	127.0	127.2	125.1	126.1	127.2
Negative polarity (kV)	125.6	123.6	127.4	127.4	126.6	125.6	126.3	125.0	125.5	125.7

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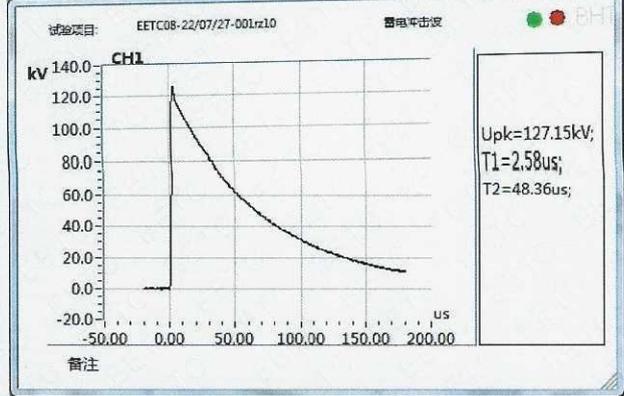
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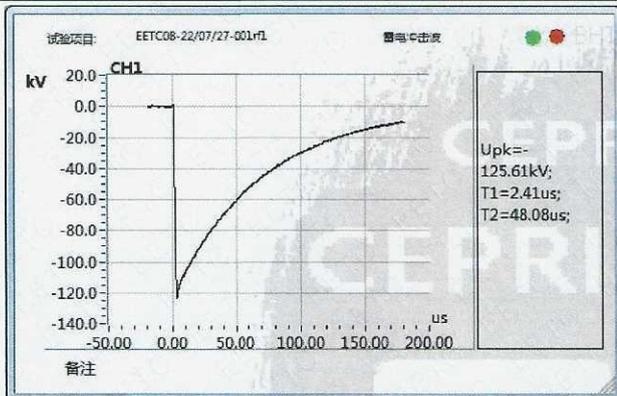
C.1.2 The waveforms of impulse voltage test



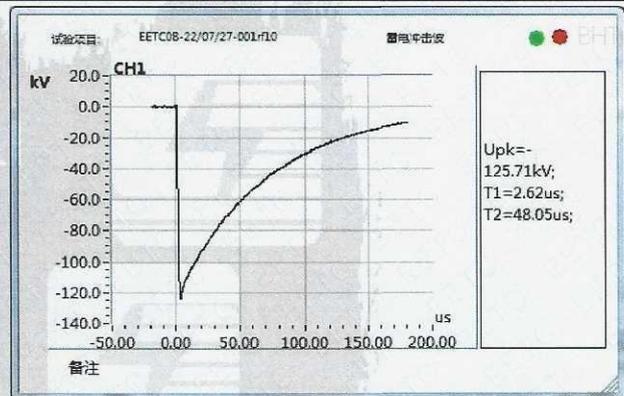
The 1st positive impulses waveform



The 10th positive impulses waveform



The 1st negative impulses waveform



The 10th negative impulses waveform

C.2 The values and waveforms of impulse voltage on the combination samples after heating cycles voltage test

C.2.1 The values of impulse voltage test

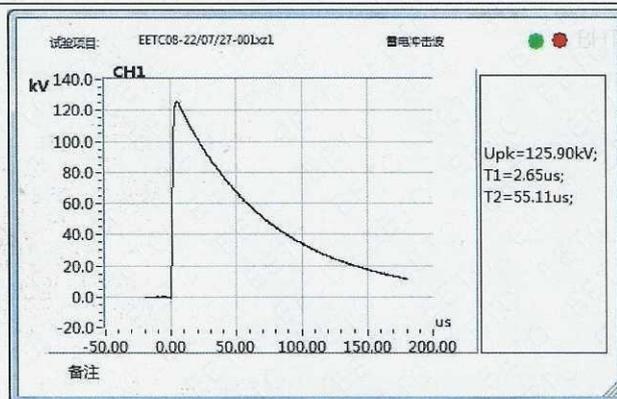
Ambient temperature: 14.0°C

Relative humidity: 36%

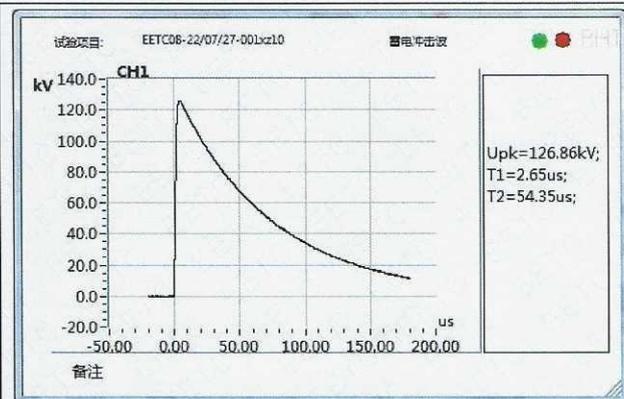
Atmosphere: 0.1016MPa

Positive polarity (kV)	125.9	126.7	126.7	126.3	126.1	126.5	126.0	125.6	126.0	126.9
Negative polarity (kV)	125.8	126.8	125.8	125.3	125.2	126.4	125.5	126.0	125.1	125.8

C.2.2 The waveforms of impulse voltage test



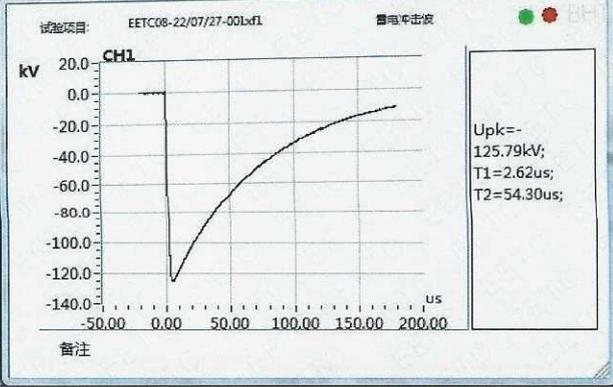
The 1st positive impulses waveform



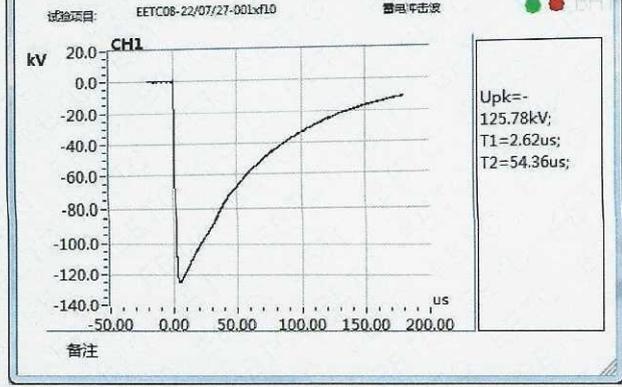
The 10th positive impulses waveform

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The 1st negative impulses waveform



The 10th negative impulses waveform

C.3 The values and waveforms of impulse voltage on the combination samples after thermal and dynamic short-circuit tests

C.3.1 The values of impulse voltage test

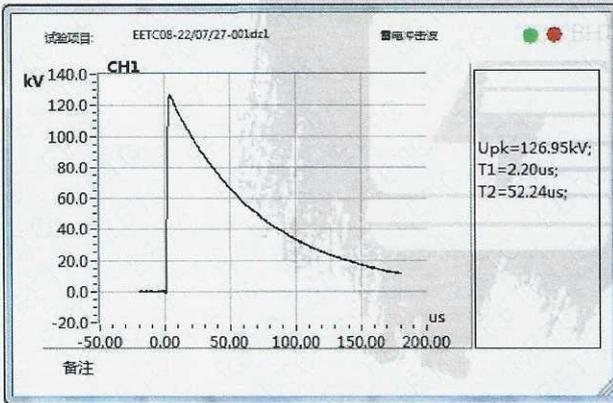
Ambient temperature: 13.1℃

Relative humidity: 58%

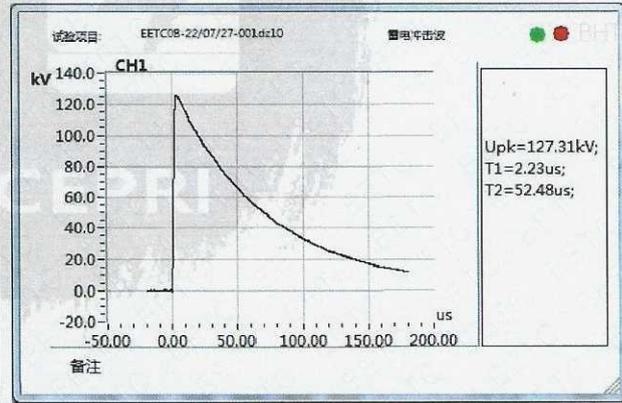
Atmosphere: 0.1017MPa

Positive polarity (kV)	127.0	127.3	126.4	127.0	127.4	127.5	127.5	127.5	127.0	127.3
Negative polarity (kV)	124.2	125.1	125.2	125.2	125.1	125.0	124.3	127.3	126.8	126.9

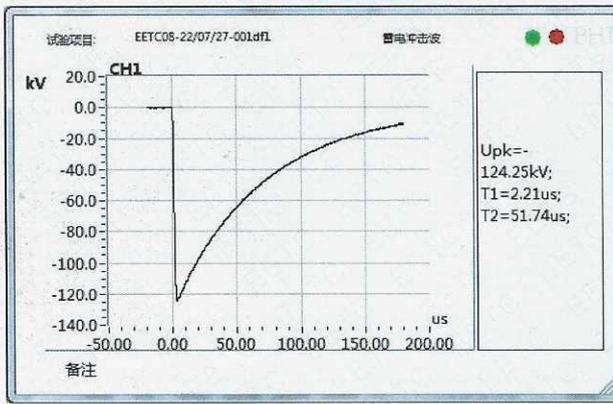
C.3.2 The waveforms of impulse voltage test



The 1st positive impulses waveform



The 10th positive impulses waveform



The 1st negative impulses waveform



The 10th negative impulses waveform

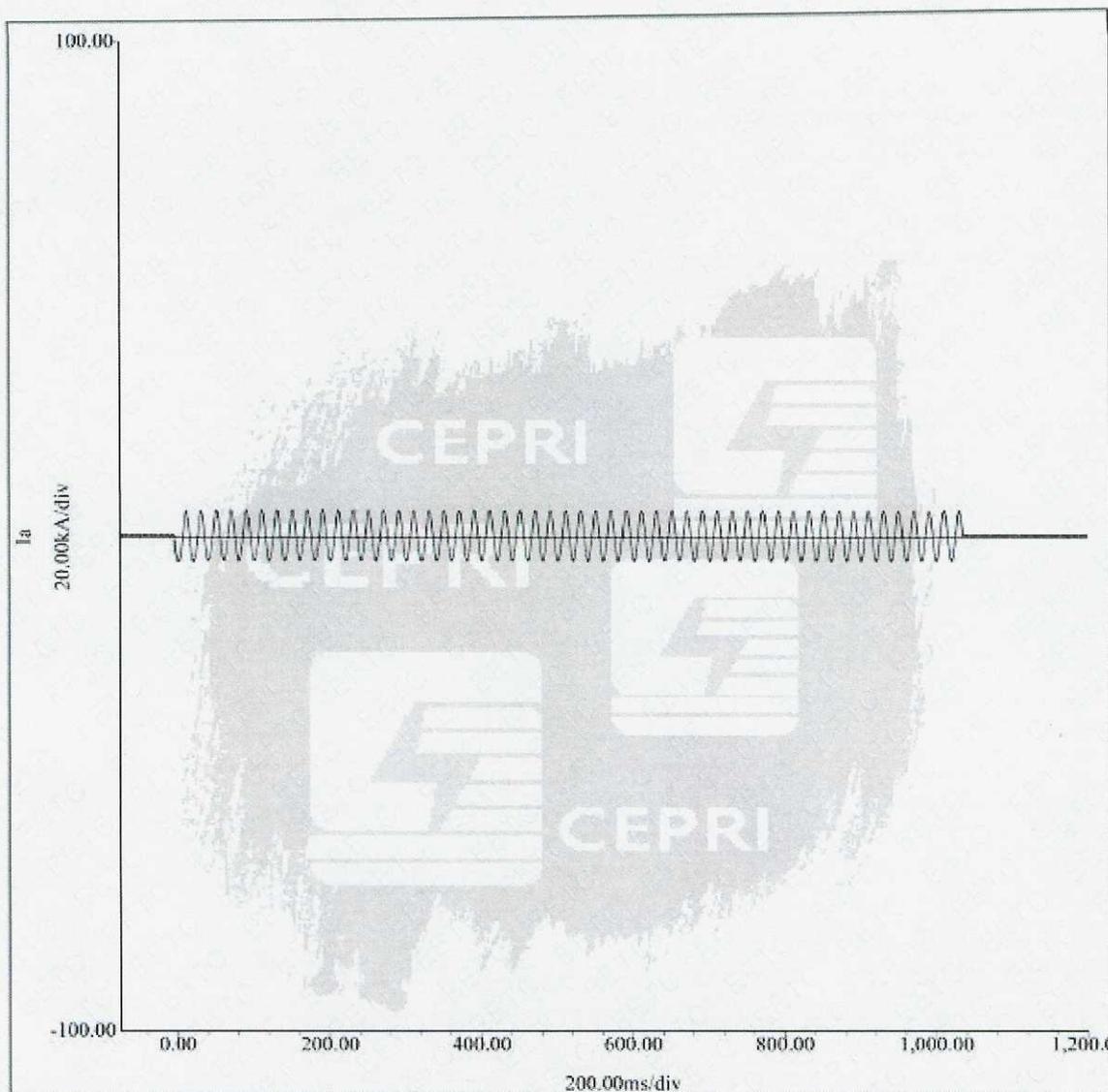
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C.4 The waveform of thermal short-circuit tests of the combination samples (screen)

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试验记录



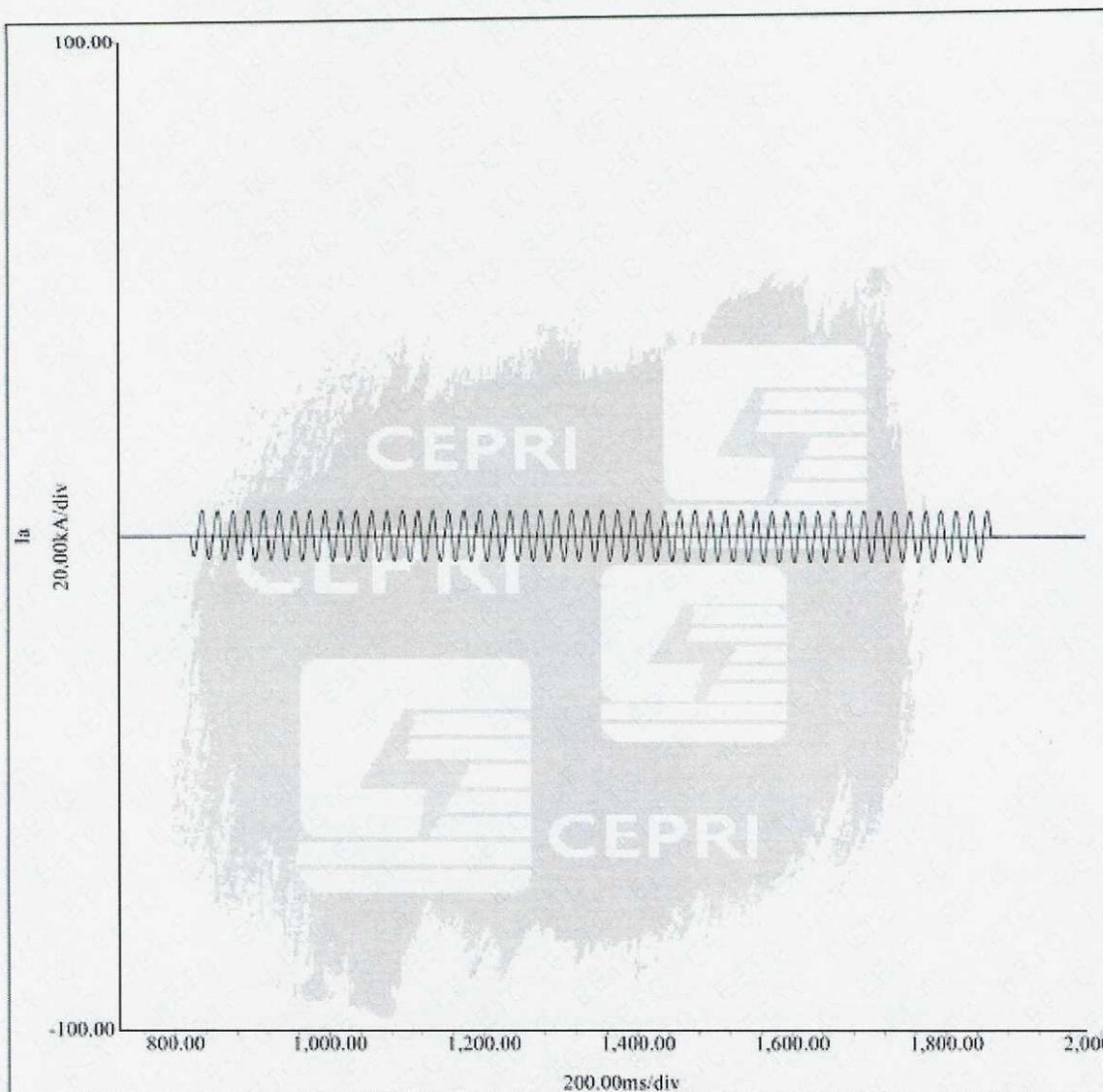
航大电气有限公司		12/20 (24) kV 屏蔽型可分离连接器		GHD-20/630A 3×185	
1040.0 ns		2023021001		/	
Ia峰值	Ia有效值	Ib峰值	Ib有效值	Ic峰值	Ic有效值
/	3.54 kA	/	/	/	/

试验中心



电力工业电气设备质量检验检测中心

试验记录



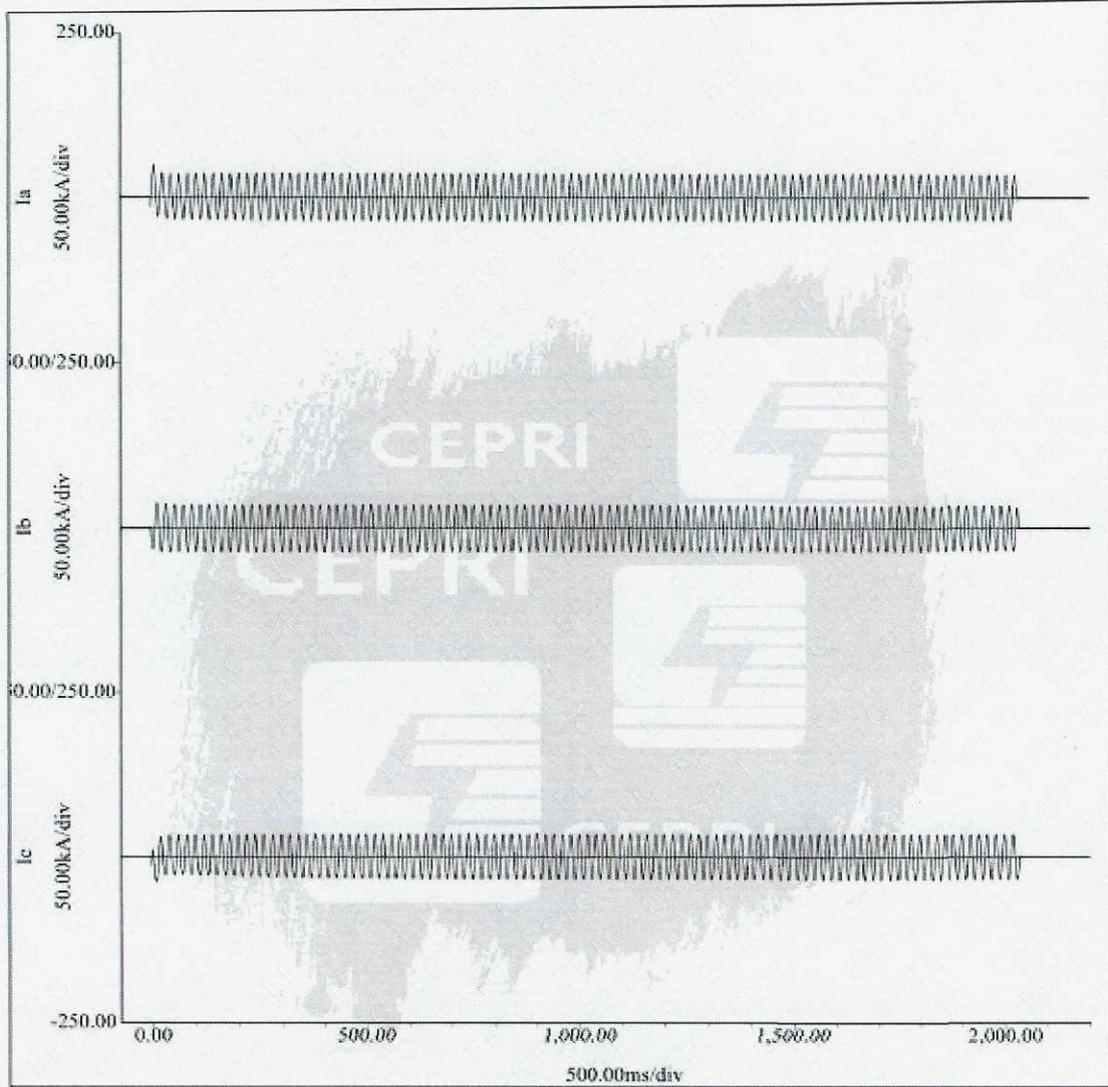
航大电气有限公司		12/20 (24) kV 屏蔽型可分离连接器		GHD-20/G30A 3×185	
1038.5 ns		2023021002		/	
Ia峰值	Ia有效值	Ib峰值	Ib有效值	Ic峰值	Ic有效值
/	3.55 kA	/	/	/	/



C.5 The waveform of thermal short-circuit tests of the combination samples (conductor)

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试验记录



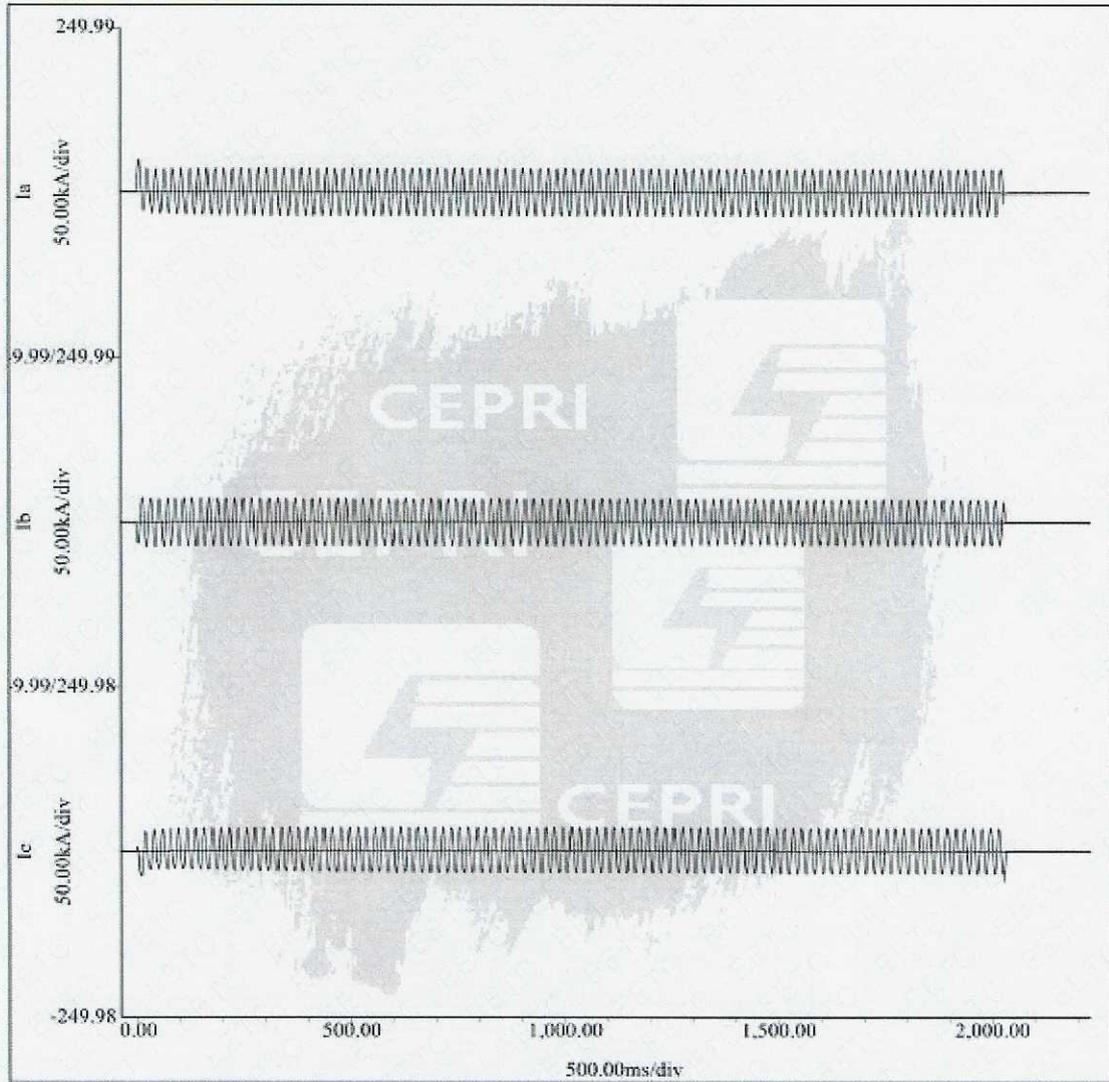
航大电气有限公司		12/20 (24) kV 屏蔽型可分离连接器		GHD-20/630A 3×185	
2032.7 ms		2023020902		/	
Ia峰值	Ia有效值	Ib峰值	Ib有效值	Ic峰值	Ic有效值
/	24.55 kA	/	24.89 kA	/	24.45 kA

航大电气



电力工业电气设备质量检验检测中心

试验记录



航大电气有限公司		12/20 (24) kV 屏蔽型可分离连接器		GHD-20/G30A 3×185	
2031.4 ms		2023020903		/	
Ia峰值	Ia有效值	Ib峰值	Ib有效值	Ic峰值	Ic有效值
/	24.76 kA	/	24.93 kA	/	24.51 kA

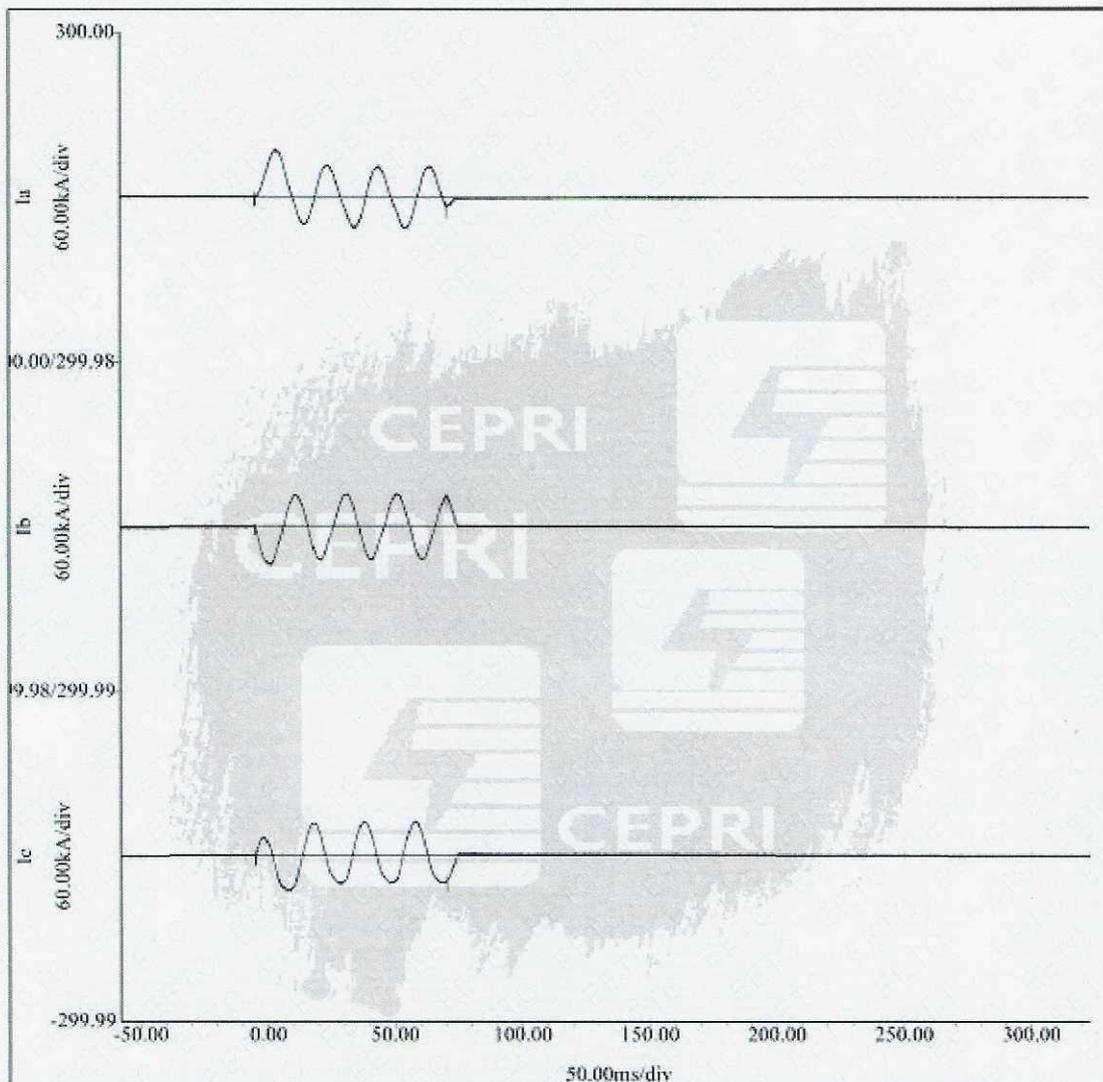
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C.6 The waveform of dynamic short-circuit tests of the combination samples (conductor)

电力工业电气设备质量检验检测中心

试验记录



航大电气有限公司		12/20 (24) kV 屏蔽型可分离连接器		GH0-20/G30A 3×185	
78.5 ms		2023020901		/	
Ia峰值	Ia有效值	Ib峰值	Ib有效值	Ic峰值	Ic有效值
85.90 kA	/	72.32 kA	/	68.15 kA	/

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Appendix D Other Information

D.1 Sample packing list

24kV 屏蔽型可分离连接器装箱清单

序号	物料名称	单位	数量
1	前接头本体	个	3
2	应力锥	个	3
3	后盖帽	个	3
4	接地线	条	3
5	不锈钢螺母	套	3
6	半导体自粘带	盒	1
7	绝缘自粘带	盒	1
8	清洁纸	包	12
9	硅脂膏	管	3
10	密封胶	包	3
11	砂纸条	条	6
12	堵头	个	3
13	六角套管	套	1
14	变径螺栓	套	3
15	铜连接端子	个	3
16	卷尺	把	1
17	美工刀	把	1
18	牙刷	把	1
19	安装说明书	份	1
20	装箱清单	份	1
21	合格证	张	1



24kV 插拔件专用冷缩装箱清单

序号	物料名称	单位	数量
1	冷缩三指套	只	1
2	冷缩绝缘管	只	3
3	冷缩密封管	只	3
4	半导电自粘带	盒	1
5	不锈钢恒力弹簧	只	3
6	接地线 (16 平方 800mm)	条	1
7	接地线 (25 平方 600mm)	条	1
8	三角锥	只	1
9	清洁纸	包	3
10	硅脂膏	管	2
11	砂纸条	条	3
12	填充胶	包	3
13	美工刀	把	1
14	密封胶	包	1
15	卷尺	把	1
16	电气胶带	个	3
17	扎带	条	3
18	安装说明书	份	1
19	装箱清单	份	1
20	合格证	份	1

D.2 Identification of test cable (specified in GB/T 12706.2—2020)

rated voltage $U_0/U(U_m)$		12/20(24) kV
construction	core	three-core
	construction of screen	separated screen
conductor	material	copper
	type	round compact stranded
	cross section	185mm ²
	diameter	16.0mm
insulation	material	XLPE
	thickness	5.6mm
	diameter	29.1mm



